PROCEEDINGS OF THE BRITISH
KINEMATOGRAPH SOCIETY

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SPICER-DUFAY COLOUR PROCESS

By

T. Thorne Baker, F.Inst.P., A.M.I.E.E., F.R.P.S.

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The Spicer-Dufay Process of natural colour kinematography is based, as I think is generally known, upon what might be called the screen plate principle. We have to go back to 1868 for the beginning of this system when Ducos de Hauron, copying the principle of the French Pontillistes, decided to try the exposure of an emulsion through numbers of juxtaposed dots of the three primary colours. Only seven years previously Clerk-Maxwell had produced the first photographs by the additive process, which was reconstructed and shown three days ago at the Cavendish Laboratory in Cambridge, where Clerk-Maxwell had worked for so many years.

There have been innumerable experiments with a view to finding some method of laying down a matrix of coloured particles of microscopic size which should act collectively as 3-colour filters such as are used in commercial 3-colour engraving. As we know, the Lumière Brothers in 1906 produced the famous Autochrome plate, in which minute granules of starch were not only laid on a plate, but were rolled and compressed so as to meet one another and thus form a more or less continuous screen matrix over which the colour sensitive emulsion is coated. Whether the space between these coloured particles be filled in with black or not is a detail of manufacture. If this is done, it, of course, means a corresponding loss in light and increase in exposure.

I do not propose to-night to take up your time with a discussion of the other processes of this nature, the Agfa plate, the Lignose film, and the excellent work of Finlay. I am going to show a thousand feet of natural colour pictures taken by the Spicer-Dufay process, and I think you will want to hear what has been done to bring this process to the successful commercial stage which has been reached after some years of continuous and difficult research.

Dufay introduced his first commercial plate in 1908 ; this was a glass plate coloured with four elements, and it could be either coated with emulsion, or used separately in contact with a plate, in the manner of the Paget colour plate. The chief interest in this plate really was that Dufay had departed from the idea of irregular grains and had formed his matrix of a geometrical pattern—a minute chessboard—in which in a square millimetre there were five green lines, 25 red and 25 blue squares. At the present time we are coating either celluloid or our own non-inflammable cellulose acetate base with a matrix of 40 lines to the millimetre ; 40 lines to the millimetre means that there are a million of these coloured squares to the square inch, and, as you will see presently from photo-micrographs which I shall show you, the formation of these minute squares is extraordinarily perfect.

The method of manufacture is briefly as follows :—

The film in 1,000 ft. lengths and 21 ins. or 42 ins. wide, is coated by means of a simple type of machine with a very thin coating of collodion. The thickness of this film is about 5 μ and it contains sufficient green dye to give the absorption required by the green primary filter.

The temperature and humidity conditions of this coating require to be adjusted with great precision, in order that the surface of the collodion may be of such exquisite flatness that it will receive the impression of these very fine lines when the coated green film is passed through a special type of rotary printing machine. The printing roller is an immensely heavy steel roller milled with 20 lines to the millimetre, and by an elaborate process of ink distribution it is coated evenly with the finest possible ink. This ink, I may say, has given us a great deal of work to do. You will know, of course, that the finest half-tone block used by printers has at most 200 lines to the inch. We are printing 1,000 lines to the inch, and instead of paper, we are printing on a difficult substance like photographic film. The inked roller touches the surface of the green film under great pressure and leaves on it a series of inked lines 1,000 to the inch. These lines are quite invisible without the use of a fairly powerful microscope. The printed film now passes through a bleaching bath, represented by the first bath in the diagram on the screen, where the space between the inked lines becomes instantly bleached. The whole function of the printed lines is to act as a protection, so that the bleaching bath cannot get to the green dye underneath it. This is what is meant in the literature by the term "fatty resist."

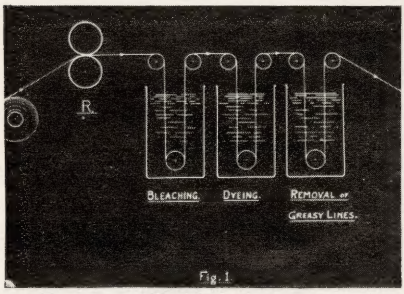

Fig. 1

When the film leaves the bleaching bath it goes straight into a second bath containing highly concentrated red dye. The bleached spaces become inmediately dyed red. The film then travels on under a number of jets of water, which wash away the excess of red dye, and it then passes through a series of tanks containing a solvent of the printing ink. It is easy to see what happens. The solvent removes the printing ink, revealing once again the green lines which it protected, and you thus get a series of green and red lines alternately such as you see in the photo-micrograph on the screen.

The next stage of the process is to print the second series of lines at right angles to these first ones. I might say that the first lines are printed at an angle of 67 degrees to the length of the film, so that the next series oflines, which provide the blue primary are printed at an angle of 23 degrees. Exactly the same process is followed, except that, in order to obtain the required balance of area between the blue, green and red patches, the width of the line is somewhat different.

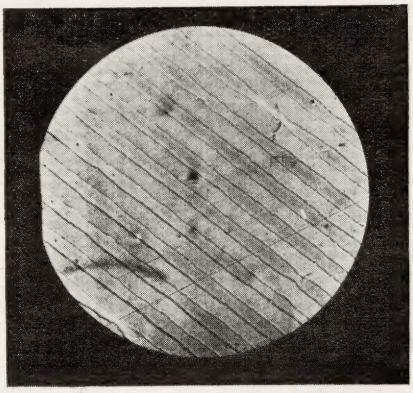

Fig. 2

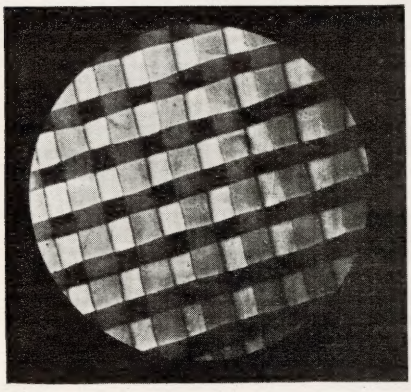

Fig. 3

After the printing of the greasy lines the film is passed through a bleaching bath once more, then through a solution of the blue-violet dye, and is finally cleaned in the ink solvent. The appearance of the film is now such as is shewn in the photo-micrograph (Fig. 3). In the case of talking pictures, we protect a track at the side of the film from receiving the resin, as seen in the next slide.

We have now a 1,000 ft. length of standard width film coated with the colour matrix or reseau. To coat the sensitive emulsion on top of this would be impossible, as the dyes have the well-known effect of acting as powerful desensitisers. The

colour matrix has, therefore, to be separated from the emulsion, and this is done by first coating it with an excessively thin layer of gelatine about 3 μ in thickness, and on top of this is coated a second layer of celluloid about the same thickness.

The finished roll then passes to the emulsioning department, where it is coated with a panchromatic emulsion which we have worked out specially for the process. The spectogram (Fig. 4), shows the colour sensitiveness to half-watt light of this emulsion, which has a speed according to our estimation of 3,000 to 4,000 H. and D.

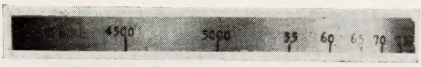

Fig. 4

I do not wish to enter into the controversial field of speed determination, but I think we can justly claim that our emulsion, to light of the average talking picture studio, is considerably faster than any other make.

The Autochrome and Agfa plates are too well known to make it necessary to describe what happens in the processing of the film. The film is self-screening ; it is used in any Kinecamera without any alteration, except that it is threaded with the film-side facing the lens, so that the emulsion is exposed through the colour matrix. The pictures are exposed at the usual rate of 16 or 24 per second, as the case may be, and using an aperture of F/2 or F/2.5 our experience is that no extra light is necessary in the studio The many artists we have engaged in our experimental studio at Sawston seem united on this point. We have, of course, photometric data of the light intensity used, which can readily be translated into terms of larger studios.

The exposed film is developed in one of the well-known baths containing a solvent of silver bromide for three minutes at 65° F., and is then put through an acid bichromate bath in order to dissolve out the original image. After reversal the film is re-developed with a simple metol-hydroquinone bath, and is then ready for printing.

It may, perhaps, be an advantage that the original negative is developed actually as a positive, and, as it only takes eight or ten minutes for the whole procedure, the producer can, if desired, see his various shots on the screen almost as fast as they are taken.

We now come to the second stage of the process—the making of duplicates. Those who have devoted any time in endeavours to copy or duplicate Autochrome or Agfa screen plates will, I am sure, realise the nature of the problem we have had to deal with in this matter. Indeed, it has been said on more than one occasion that to copy a screen image with a geometrical pattern is an impossibility. No process of this kind is of any commercial value unless the duplication is both commercial and good. The technique we have worked out for duplicates is briefly as follows :—

A standard type of projection printer (a Debrie in our case), is used with the three following slight modifications :—

(1) A special lens working at F/2 has been designed, which gives us extremely critical definition of the silver image, while slightly diffusing the image of the matrix, which, as you will remember, is separated from the silver image by a distance of 6μ.

(2) Between the lens and the copying film is a piece of special shaped glass, which we call the diffuser. This further throws out the image of the reseau, and makes moiré pattern practically an impossibility.

(3) In order to control the brightness of the light as the density of the original varies, we employ a rotating drum containing a number of neutral grey filters. We cannot alter the strength of the lamp in the ordinary way, because the introduction of resistance into its circuit would alter the spectral distribution. The various neutral grey filters are swung into position quite easily and automatically, and in this way long lengths of films can be printed, with perfect results. The standard rate of printing obtains, *viz.*, 800 pictures per minute.

In the pictures which I shall show presently, the originals, termed by us Master Positives, and duplicates are mixed indiscriminately, and, although the duplicates are not quite as perfect as the originals, it must be remembered that the public will only see the copies, and, having no standard of comparison, will be perfectly satisfied. There is one point I should like to add in connection with duplicates, and that is, that quite unexpected progress during the last month or two on certain new lines of investigation leads us to feel certain that in the very near future it will be impossible to tell the copy from the original.

Before showing the pictures there are one or two points of interest in connection with the sensitometry of the high speed colour screen emulsions which it may be of interest to touch upon.

It is, of course, obvious that the grain size of the emulsion must be very small. Consider, for example, the colour chart photograph, first as a negative in complementary colours, and secondly as a positive. Any one of these colours *owes* its colour to the fact that only those parts of the spectrum which compose it are allowed to pass through the film. In the case of a green leaf in a landscape, for example, if it were pure green the blue squares and the red squares in the matrix would be completely blocked out by silver deposit, so that light could only traverse the film through the green components of the matrix. The same with the other colours. It is, therefore, indispensable in order to get a pure colour, to have the blacks so opaque that no light can get through them.

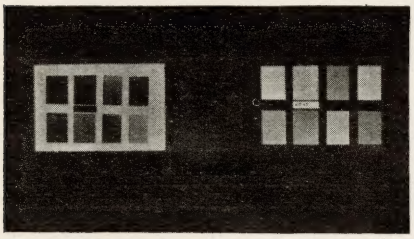

Fig. 5

At first sight, the most obvious type of emulsion would be the "soot and whitewash" type employed by the process engraver. But such emulsions have an extremely short scale of gradation, whereas in our case we want a very long scale of gradation, because, in order to get the infinite number of delicate intermediate colours which exist in Nature, we must have mixtures in varying proportions of the three primary colours. To get such proportions we must, of course, have an equally infinite scale of variation in the density of the silver deposit.

Fig. 6

A studio shot developed half as a negative and half as a reversed transparency.

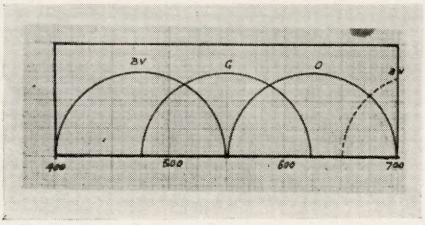

Fig. 7

In order to get this unlimited blending of the three primaries, I have always held that the spectrum should be treated as a matter of geometry—in other words, each primary should have a maximum in the centre of its region of transmission and should taper off symmetrically on either side, as shown in the diagram on the screen. When putting forward this theory, in 1905, I was vigorously attacked by other colour technicians, and I believe that to-day the view generally held is that the spectrum should be more or less divided into three water-tight compartments—each section, at any rate, should only slightly overlap the next.

If the geometrical arrangement I have shown be adopted, the eye itself takes care that the various mixtures of the three primaries have the required luminosity; this is a purely physiological matter. To use that old phrase, "the proof of the pudding is in the eating," and I might add that the use of such filters is the only possible way of reproducing by the additive process the full spectrum in faithful colour rendering; I think, too, you will admit when you see the pictures we are showing presently that our colour rendering is of a very high order.

The next slide shows how very wide the overlaps of our primaries are. You will see against each of them the transmission of the usually accepted additive filters, and how very much more condensed, *i.e.*, not overlapping, the latter are. We use these big overlaps, each primary tailing off into the next, for both taking and copying, and they

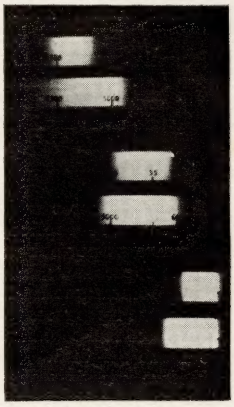

Fig. 8

have certainly borne out our highest hopes, and incidentally have greatly increased the luminosity of the pictures. The absorption of the matrix or reseau has been reduced from over 90 per cent. to about 65 per cent., thus making the light transmitted nearly 3½ times greater.

To return now to the emulsion. This must be capable of giving the intensity of black of a process emulsion, and yet must have a perfect scale of gradation corresponding to the whole of the light intensities used in making a picture. Those interested in sensitometry will appreciate the fact that, with so much light absorbed by the reseau, the inertia effect would become very pronounced in the shadows if the characteristic curve in the emulsion were to have a long foot. I have a diagram showing the characteristic curve of the Spicer-Dufay emulsion as against the classic S-shaped curve of Hürter & Driffield.

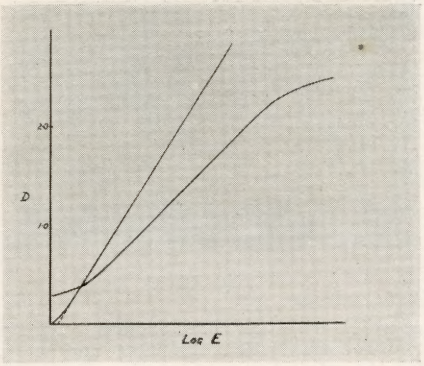

Fig. 9

The next slide shows how, after the original image is dissolved out by acid bichromate or acid permanganate, and the balance of unexposed silver salts developed, the characteristic curve of the reversed picture is a mirror image of the original.

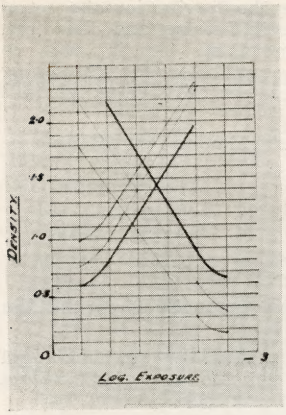

Fig. 10

On this diagram there are three sets of curves for different times of development, but in each case the result is the same. We are, however, faced with one difficulty, and that is latitude. In the next slide are seen three sets of diagrammatic curves.

Figure 1 we will imagine to be that of a perfect negative with a gamma of 1, the shaded portion representing the original deposit. When this is dissolved away and the film re-developed, the unexposed silver salts blacken and we get a reversed picture indicated by the black portion. If we have a very steep curve and development proceeds too far we get reversal as is seen in Figure 2, an image—certainly equally steep—but obviously very much too poor in silver. On the other hand, if we do not develop sufficiently, and have a flat picture, as indicated in Figure 3, then on reversal we shall have too much silver to convert and the result will be too dense an image, as represented by the clear portion.

Rahts and Schutz have stated in a communication to the VIIIth International Congress of Photography that there is a latitude in exposure with Agfa plates of 1 to 16. This takes into consideration the fact that these various faults we have just seen can be corrected by suitable treatment. A preliminary hypo bath before the second development will correct the undue amount of unexposed silver in Figure 3, while shortening development will correct the fault in Figure 2, but in commercial kinematography we have got to remember that hundreds of feet of film at a time, consisting of various shots in the studio where lighting may constantly change both in character and intensity, necessitate flexibility of treatment, which is not in any way comparable with what can be given to an individual amateur plate. We estimate that the latitude in taking a Spicer film is about 1 to 3 for over exposure and 1 to ⅓ in the case of under exposure. One might call this a latitude of 1 to 9, but I prefer to call it a latitude of three times on either side of the correct exposure line. A further feature of the Spicer emulsion is the very small gelatine/silver ratio (only about 0·9 to 1), which has the

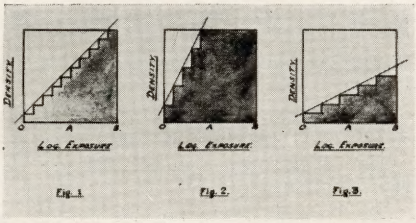

Fig. 11

effect on development shown in the next diagram. Here we see a family of H. and D. curves for six times the development. The gamma rises with increasing time of development up to a point, after which the maximum black having developed, the shadows continue to develop, the result being that the gamma slightly *decreases*. This characteristic of our emulsion is a valuable one to the producer. The effect of the gelatin/silver ratio on time of development is seen in the diagram.

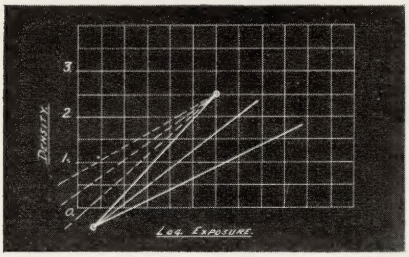

Fig. 12

In conclusion I would like to draw attention to the question of illumination. It looked some time ago as though half-watt lamps would come into general use in view of the talking picture, but it is generally agreed that sufficient life and modelling cannot be got into the photograph without the use of arcs, quite apart from the question of heat. Arc lamps, especially high intensity ones, are usually employed the carbons of which are either cored or impregnated with metallic salts. Either core or impregnation necessarily tints the flame, and here arises a new point of difficulty in standardisation in colour kinematography. A camera man who knows his studio, and who knows the spectroscopic composition of his various light units, can by computation, or trial and error even, correct the falseness of his light in the studio. But a thing which we have found rather disconcerting is that a film in natural colours which appears absolutely perfect when projected in one theatre will look too bluish, or too greenish, or perhaps too yellow in another one, and on investigating the distribution of spectral emission of various makes of carbons used in projectors in London and elsewhere, we find a very alarming difference in the colour of the flame given. This is a point to which I would draw urgent attention, as in the event of natural colour films becoming very general, as I feel convinced they will do, some standard source of white light will have to be adopted in the theatre for projection.

This completes what I have to say on the production of the film, and we will now see some of the results on the screen.

THE SPICER-DUFAY COLOUR PROCESS

QUESTIONS.

MR. VINTEN : I would like to know why the lines are run diagonally across the film instead of in the direction of the film.

MR. THORNE BAKER : It is the result of a great deal of experiment. We have found from practical observation that by having one line at 67° and the other at 23° we get the least visibility of the matrix from the nearer seats in the theatre.

MR. VINTEN : It gives one the impression that the lines run across the sheet against a particular coloured subject and rather looks as if it tends to exaggerate the lines.

MR. THORNE BAKER : The pictures I have shown with the exception of the boys in the swimming pool are 30 to the m.m. ; the boys were 36 to the m.m., and we have now got up to 40 to the m.m.

MR. VINTEN : The pool certainly was a superior picture from here. Could we have the opinion of somebody at the back of the room.

MR. EVELEIGH : I was in that position, and when I got past the table on which the lantern is I lost the lines altogether.

MR. THORNE BAKER : Our general experience in London theatres is that after the sixth row of the stalls the lines are quite invisible.

MR. HODGSON : Can Mr. Thorne Baker tell us which were originals and which reproductions ?

MR. THORNE BAKER : About one-third of the pictures were copies and about two-thirds originals. I do not think it is fair at this stage to make a run, as we have to-day, of original and copy one after the other. The reel you have seen is an indiscriminate mixture of originals and copies. We can get any number of copies. In many colour processes, if you make 50 copies there is a certain variation in the results, but that variation does not exist in this process.

MR. SERLE : What is the portion of light required for this process against the normal black and white photography in the studios and operating boxes?

MR. THORNE BAKER : As regards the studio work, first of all we have a number of artistes down for our experiments, and have always very closely examined them as to their own feeling about the light, and in all cases it has been that it is " no stronger than at Elstree." We were asked by Lord Rutherford to photograph the recent procession at Cambridge of famous scientists in their full robes. We took two or three hundred feet at 3.20 without sun and it was perfectly exposed. That was using F2/5; that will give some idea of the fact that extra light is not necessary.

MR. WILLIAMSON : Mr. Baker has shown us that the original base is milled and coloured before the emulsion is applied and before sheets of base are cut into strips; what effect does that have upon sound tracks, either variable area or variable density. You showed also a slide with a green sound track, but it was not shown whether the green removed the milling or left it there.

MR. THORNE BAKER : In making the film after the green coating has gone on we put it in a machine which runs a series of stripes in bitumen which protects the sound track. When the printed film is run through the benzine bath the benzine removes the bitumen and leaves the green coating underneath; it has been suggested that owing to the fineness of the matrix it would cause no harm to the sound itself. We have made records with the variable area and variable density methods, and we find that reversal does not affect the quality of the sound.

MR. EVELEIGH : I would like to ask Mr. Baker if he has photographed with this process anything with parallel lines or horizontal and vertical lines together; I have in mind such a thing as the top of a tower with battlements. The reason I ask is that some years ago someone I know was experimenting with a like process and the thing which decided him to give it up altogether was that he could not get a good photograph of a tower with battlements, these registering as sine curves and not as straight lines.

MR. THORNE BAKER : I should imagine there was some unfortunate co-relation between the outlines and the matrix.

MR. EVELEIGH : No, he took it at various angles.

MR. THORNE BAKER : I think the best illustration is that in photographs of gardens where you get notices like " Please keep off the grass "; the print is sharply defined in the present process.

MR. EVELEIGH : He did not refer to that, but such things as battlements; he got a perfect sine curve and whatever he did he could not get rid of it.

MR. HODGSON : I notice that some of the shots on the screen seemed absolutely stationary; with other shots the screen seemed to travel from the left to the right. I should like to have that explained if possible.

Another point, one of the bathing girls reading a magazine; from where I am sitting I could see the print of the magazine was not black and white at all, but red and green definitely picked out.

MR. THORNE BAKER : I cannot offer any explanation of the fact that in some pictures the lines seem to travel across, but that is one of the points that will be eliminated by the use of the finer screen.

With regard to the printing appearing red and green, it is because its size is a multiple of the matrix; but that is a coincidence which only rarely happens.

MR. HODGSON : The green predominates exceedingly.

MR. THORNE BAKER : The general idea about that is that the under-exposed shots are either too green or too blue, and the over-exposed either too bluish or slightly pink, but I think it is only right to confess that some of our pictures are picked from various shots taken during various stages of our progress; as regards outdoor work we are dealing with compensating filters, and I think some of the colour values are rather influenced by that work not having been quite finished.

MR. WILLIAMSON : I noticed an early shot of a man with a blue velvet costume, and the man's coat seemed to change considerably.

MR. THORNE BAKER : Yes, but they were different colours and different men; one was taken in Cambridge and the other in Nice.

MR. ROSS : In regard to exterior shots there are rather heavy shadows; will you say whether you have taken that with natural shadows?

MR. THORNE BAKER : These pictures were taken in the South of France in December and January when the sun was rather low, and the shadows would be much heavier than in the summer time.

MR. SERLE : Is it an essential characteristic of three-colour processes to show all the colours brighter than they normally appear.

MR. THORNE BAKER : No, I think where the colours are brighter than they are normally, the explanation is that the spectrum has been divided into watertight compartments.

MR. L. ROWSON : Arising out of Mr. Ross's question, the usual practice in black and white photography is to over-expose to soften the shadows ; is it possible to do this in the colour process ?

MR. THORNE BAKER : If it is over-exposed altogether it would appear soft and grey, or flat ; you get the same thing in this process, but the truth of the colour rendering is maintained except that the hues may be rather too light.

MR. L. ROWSON : I mean over-exposing to the extent that the thing becomes just flat enough to soften.

MR. THORNE BAKER : I do not think we have had enough experience of camera work ; ours has all been laboratory work. One or two of the film people have told us that we do not know what could be done with this process if we worked in a big studio, with their technicians.

MR. HODGSON : Was there any special type of make-up or just black and white make up in the interior shots ?

MR. THORNE BAKER : No special make-up, but we are beginning to experiment with it. That is going to be a special study in itself, but up to the present the girls have all had on make-up in the ordinary way.

MR. WATTS : Is Mr. Baker still using non-flam stock ?

MR. THORNE BAKER : Yes.

MR. WATTS : Is there any trouble as regards peeling ?

MR. THORNE BAKER : No, not now. Some of the shots you have seen in this special piece have been shown 200 times.

MR. S. ROWSON : Is the non-flam film an integral part of your process ?

MR. THORNE BAKER : No, we can use nitro stock just the same.

MR. VINTEN : Dealing with the printing proposition. Is there any difficulty in keeping the print in correct register with the negative due to the additional thickness ? Also is there any difficulty in keeping the lines in strict register ?

MR. THORNE BAKER : There is no question of lack of register. The only thing being that with a lens of very wide aperture, F/2, we have to focus critically ; the matrix and the silver image being in optical contact, there can be no question of any displacement.

MR. HUDSON : Do you have any difficulty in balancing your colour rendering for interiors and exteriors ? In sunlight the colours are brilliant, but any diffusion would bring your colours much duller. Have you any process by which you can balance your results ?

MR. THORNE BAKER : I think I can answer that best by giving an idea of the routine test of our stock. It is tested first of all on a colour chart in the studio, and then the colour chart and the man holding it are taken out into the daylight ; the daylight filter is used and the shots taken again, and I do not think it is possible to tell one from the other. We know that as the sun goes in and out the whole colour scheme changes.

MR. HUDSON : Arising out of that—we have heard that you use a daylight compensating screen ; that is something. The next point, we know the value of light, and when using incandescent lamps we get a strong light, and the light seems to be yellow. Now we are getting colour it seems to me we are going to get more and more complicated. It is a point worth considering as to whether you are going to recommend a definite system of lighting and lamps with your screens.

MR. THORNE BAKER : One of the things I am hoping to raise later on is the panchromatic carbon ; with it you may have to introduce some type of colour filter. With colour I think when the public have become used to natural colour films, they will demand them as they have demanded sound films, and I think the unfortunate colour men will have to put up with the extra work.

MR. PHILLIPS : Can you correct, in printing, errors in exposure ?

MR. THORNE BAKER : It is, I think, best to develop a small piece of film first, as it is desirable to get exposure and development co-ordinated so that you get the best results in the master.

MR. LUCAS: Has Mr. Baker any figures giving the possible relative cost of this process compared with the ordinary processes?

MR. THORNE BAKER: We have got all those figures, but I would not like to discuss them to-night. There is no arrangement at the present moment for producing the stock in a commercial way and it will probably take some months, and during that interval I would rather be excused from going into that point. I will only say as far as we are concerned, the cost is very little over that of black and white.

MR. WALEY: Can you tell us whether the process is going to be available in the 16 m.m. film?

MR. THORNE BAKER: We have made quite a lot of 16 m.m. shots and put them through the standard Kodak projector. The loss of light is about the same as with Kodacolor.

DISCUSSION

MR. ROSS: In regard to my query about the reflection, why I asked that was this. During the time I have been photographing black and white I have had many other people come along with colour cameras and they have been afraid to take something except without any light and shade, and that is why I wanted to know if I could get some idea as to whether it was natural light, and understanding that it is from Mr. Thorne Baker, I think it is the most marvellous thing I have ever seen.

MR VINTEN: I have had a good many years on colour. I have seen a good deal of stuff during my years of working and got the impression it is very detrimental to use colours in a darkened cinematograph hall. The colour pictures seem to be over brilliant and over coloured. The best Kinemacolour pictures produced were those where they selected neutral tints and they balanced the extra brilliant scenes from an arc light. The right way, I think, to develop colour photography is to increase the light somehow in the theatre so that we do not get such a contrast.

MR. EVELEIGH: Arising out of Mr. Vinten's question, it is, I think, a Home Office order that there is a certain amount of light in a theatre. That varies according to the taste of the lighting engineer in the first place. As to the actual rays sent out by the lamps during the preformance, I have seen various types of colour schemes used, and I cannot say I have noticed any difference in the picture on the screen, whilst the house lighting is on. We have seen these to-night without any light at all. Arising out of that very thing, has Mr. Baker seen this reel in a theatre with the full lighting on or only with the house lights on? It would be rather interesting to know.

MR. THORNE BAKER: With the ordinary lights down.

MR. VINTEN: Take a 16 m.m. colour film and run it on a daylight projector and you will find the colours are far more pleasing than when run with artificial lights.

MR. WILLIAMSON: This is the only three colour process that I have seen, other than the old Zoechrome, and following Mr. Ross's question of light, in the old days I think people thought that colour processes were handicapped by the slow development of stocks. To-day I think we can dispense with Mr. Ross's objections by saying that every commercial colour process can be used in the studio to-day. The results to-night certainly have reproduced more colours, more faithfully, than perhaps anything I have ever seen. It will become an art to use colour, and undoubtedly we are going to add to the studio staffs by having colour experts, who will know how to get the most pleasing results on the screen. The disadvantage of the two-colour process may be overcome by artistry in the studio and in the setting. I am naturally one who believes more and more strongly that colour is the next development, and the more of these processes that are made commercial and pleasing, I think the sooner it will be that the general use of colour will come about. I feel it may be some time yet before it is in general use because people may be frightened of it. All the processes, Technicolour, Multicolour, and several others aim at giving the studio executives and the studio operators as little trouble as possible, and I think that is a strong point in favour of this process that all the work is done at the laboratory end and not the studio.

MR. WILLIAMSON, SENR.: From what I have seen to-night it seems to me to be "it"—what we have been waiting for all these years. You are apparently going to give us a film which we can expose in a camera in the same way as we had to do with a coloured plate. If a film is going to be produced and reproduced in that simple way, I think I am justified in saying that the Spicer-Dufay film is "it."

MR. EVELEIGH: I think Mr. Vinten has given me this idea. Have you tried projecting this through a ground glass screen, in other words back projection?

MR. THORNE BAKER : Yes.

MR. EVELEIGH : I once had a very great surprise. I was asked to show a colour picture in broad sunlight on the daylight screen of the Conservative Party's Open-Air Van. I was interested, and went down to Lupus Street Coaching Station and the van was in the open square with the sun directly on it. The picture certainly looked better there than in a theatre ; I have never seen it to such advantage on the screen in a theatre.

MR. NEWMAN : I went a little while ago to see some of these pictures, and the effect seemed to me nothing approaching any of the pictures I have seen this evening. It struck me then that the colours were muddy as compared to what I have seen to-night. I do not see that result here to the extent I have seen it in other processes, and the pictures I have seen to-night compare very favourably with anything I have ever seen.

CAPT. WEST : I think I have experienced a great feeling of ease in looking at these pictures to-night and it was rather a relief after seeing colour films taken in two colours. It seems to be approaching the naturalness which we are hoping to get in the production of the pictures as well as the sound. It is really very marvellous, and I think everybody will agree we have advanced very considerably over any two-colour process.

I therefore propose a very hearty vote of thanks to Mr. Thorne Baker for his Paper to-night.

MR. ELWELL : I have much pleasure in seconding that.

MR. S. ROWSON : In the first place it appears to me that Mr. Thorne Baker has described results which may presage a revolution in the cinematograph trade in this country, and later may help us to create as great a revolution in the United States as that imposed upon us when sound was introduced three years ago. It may become a key by which we shall be able to open many of the closed doors of foreign markets to British films. Secondly, I would like to say I agree with those who hold the view that as soon as we get a natural colour film it will be used universally ; I have always believed it and have always waited for it ; I have no doubt that Mr. Thorne Baker will admit that even films such as he has shown to-night are capable of colour improvement.

I quite agree with Mr. Williamson, Senr., that there has been no demonstration like it anywhere else, and we look like getting " it," seeing that Mr. Thorne Baker tells us that the work in the studio is not much different, that the processing is not very much different, and the cost not much more than these are at present.

I have much pleasure in telling Mr. Baker that the British Kinematograph Society thanks him very heartily for his paper this evening.

Printed by J. G. Hammond & Co., Ltd., 139, Moor Street, Birmingham, and London.